

# CLAIMS

What is claimed is:

- 1 1. An apparatus comprising:  
 2 an estimating unit to estimate a distribution of input signal level; and  
 3 an integrator to adjust a gain based upon the distribution for an automatic gain  
 4 control.
- 1 2. The apparatus of claim 1, wherein the estimating unit comprises:  
 2 a comparator to compare the input signal against one or more reference  
 3 threshold values; and  
 4 a counter to estimate the distribution by counting occurrences in which the input  
 5 signal level is either above or below the one or more reference threshold values within  
 6 a given period.
- 1 3. The apparatus of claim 2, wherein:  
 2 the comparator compares the input signal level against a first reference  
 3 threshold value and a second threshold value; and  
 4 the counter counts occurrences in which the input signal level is above the first  
 5 reference threshold value and occurrences in which the input signal level is below the  
 6 second reference threshold value.
- 1 4. The apparatus of claim 3, wherein the first reference threshold value is higher  
 2 than the second reference threshold value.
- 1 5. The apparatus of claim 4, wherein the counter counts up when the input signal  
 2 level is above the first reference threshold value and counts down when the input signal  
 3 level is below the second reference threshold value.
- 1 6. The apparatus of claim 2, wherein the integrator adjusts the gain based upon the  
 2 occurrences counted during the given period.

- 1 7. The apparatus of claim 2, wherein the estimating unit further comprises a  
 2 variable step size generator, and wherein:  
 3 the counter to determine a percentage of time that the input signal level is either  
 4 above or below the one or more reference threshold values within the given period, and  
 5 generates an error signal;  
 6 the variable step size generator to select a step size factor based upon the error  
 7 signal and to multiply the error signal with the selected step size factor to generate a  
 8 variable error signal; and  
 9 the integrator to adjust the gain in accordance with the variable error signal.
- 1 8. The apparatus of claim 7, wherein the variable step size generator selects a large  
 2 step size factor if the error signal is above a predetermined value.
- 1 9. The apparatus of claim 1, further comprising a variable step size generator to  
 2 vary the speed by which the integrator adjusts the gain by gear shifting based upon the  
 3 distribution.
- 1 10. A method comprising:  
 2 estimating a distribution of input signal level; and  
 3 adjusting a gain based upon the distribution for an automatic gain control.
- 1 11. The method of claim 10, wherein estimating the distribution comprises:  
 2 comparing the input signal level against one or more reference threshold values;  
 3 and  
 4 estimating the distribution by counting occurrences in which the input signal  
 5 level is either above or below the one or more reference threshold values within a given  
 6 period.
- 1 12. The method of claim 11, wherein:  
 2 comparing the input signal level against a first reference threshold value and a  
 3 second threshold value; and

4 counting occurrences in which the input signal level is above the first reference  
5 threshold value and occurrences in which the input signal level is below the second  
6 reference threshold value.

1 13. The method of claim 12, wherein the first reference threshold value is higher  
2 than the second reference threshold value.

1 14. The method of claim 13, wherein counting up when the input signal level is  
2 above the first reference threshold value and counting down when the input signal level  
3 is below the second reference threshold value.

1 15. The method of claim 11, wherein adjusting the automatic gain control based  
2 upon the occurrences counted during the given period.

1 16. The method of claim 11, wherein estimating the distribution further comprises:  
2 determining a percentage of time that the input signal level is either above or  
3 below the one or more reference threshold values within the given period, and  
4 generating an error signal;  
5 selecting a step size factor based upon the error signal and multiplying the error  
6 signal with the selected step size factor to generate a variable error signal; and  
7 adjusting the gain in accordance with the variable error signal.

1 17. The method of claim 16, wherein selecting a large step size factor if the error  
2 signal is above a predetermined value.

1 18. The method of claim 10, further comprising varying the speed by which the  
2 gain is adjusted by gear shifting based upon the distribution.

1 19. An instruction loaded in a machine readable medium comprising:  
2 a first group of instructions to estimate a distribution of input signal level; and  
3 a second group of instruction to adjust a gain based upon the distribution for an  
4 automatic gain control.

1 20. The instruction of claim 19, wherein the first group of instructions comprises:  
2 a third group of instructions to compare the input signal level against one or  
3 more reference threshold values; and  
4 a fourth group of instructions to estimate the distribution by counting  
5 occurrences in which the input signal level is either above or below the one or more  
6 reference threshold values within a given period.

1 21. The instruction of claim 20, wherein:  
2 the third group of instructions include instructions to compare the input signal  
3 level against a first reference threshold value and a second threshold value; and  
4 the fourth group of instructions include instructions to count occurrences in  
5 which the input signal level is above the first reference threshold value and occurrences  
6 in which the input signal level is below the second reference threshold value.

1 22. The instructions of claim 20, wherein the first group of instructions further  
2 comprises a fifth group of instructions, and wherein:  
3 the fourth group of instructions to determine a percentage of time that the input  
4 signal level is either above or below the one or more reference threshold values within  
5 the given period, and generating an error signal;  
6 the fifth group of instructions to select a step size factor based upon the error  
7 signal and to multiply the error signal with the selected step size factor to generate a  
8 variable error signal; and  
9 the second group of instructions to adjust the gain in accordance with the  
10 variable error signal.

1 23. The instruction of claim 19, further comprising a third group of instructions to  
2 vary the speed by which the gain is adjusted by gear shifting based upon the  
3 distribution.

1 24. A communication system comprising:  
2 a transmitter to transmit an analog signal;

a receiver to receive the analog signal, the receiver including an automatic gain control unit to maintain a constant level of the analog signal for processing in the receiver, the automatic gain control unit including:

an estimating unit to estimate a distribution of input signal level; and  
an integrator to adjust a gain based upon the distribution for the automatic gain control.

25. The communication system of claim 24, wherein the estimating unit comprises:

a comparator to compare the input signal level against one or more reference threshold values; and

a counter to estimate the distribution by counting occurrences in which the input signal level is either above or below the one or more reference threshold values within a given period.

26. The communication system of claim 25, wherein:

the comparator compares the input signal level against a first reference threshold value and a second threshold value; and

the counter counts occurrences in which the input signal level is above the first reference threshold value and occurrences in which the input signal level is below the second reference threshold value.

27. The communication system of claim 26, wherein the first reference threshold value is higher than the second reference threshold value.

28. The communication system of claim 25, wherein the automatic gain control unit further comprises a variable step size generator, and wherein:

the counter determines a percentage of time that the input signal level is either above or below the one or more reference threshold values within the given period, and generate an error signal;

the variable step size generator selects a step size factor based upon the error signal and multiplies the error signal with the selected step size factor to generate a variable error signal; and

the integrator adjusts the gain in accordance with the variable error signal.

1 29. An automatic gain control apparatus comprising:  
2 a comparator to compare input signal level against one or more reference  
3 threshold values;  
4 a counter to count occurrences in which the input signal level is either above or  
5 below the one or more reference threshold values within a given period; and  
6 an integrator to adjust a gain for automatic gain control, the gain adjusted based  
7 upon the occurrences counted.

1 30. The apparatus of claim 29, wherein:  
2 the comparator compares the input signal level against a first reference  
3 threshold value and a second threshold value; and  
4 the counter counts occurrences in which the input signal level is above the first  
5 reference threshold value and occurrences in which the input signal level is below the  
6 second reference threshold value.

1 31. The apparatus of claim 30, wherein the first reference threshold value is higher  
2 than the second reference threshold value.

1 32. The apparatus of claim 31, wherein the counter counts up when the input signal  
2 level is above the first reference threshold value and counts down when the input signal  
3 level is below the second reference threshold value.

1 33. The apparatus of claim 29, further comprising a variable step size generator, and  
2 wherein:

3 the counter determines a percentage of time that the input signal level is either  
4 above or below the one or more reference threshold values within the given period, and  
5 generate an error signal;

6 the variable step size generator selects a step size factor based upon the error  
7 signal and multiplies the error signal with the selected step size factor to generate a  
8 variable error signal; and

9 the integrator adjusts the gain in accordance with the variable error signal.

1 34. A method for automatic gain control comprising:  
2 comparing input signal level against one or more reference threshold values;  
3 counting occurrences in which the input signal level is either above or below the  
4 one or more reference threshold values within a given period; and  
5 adjusting a gain for automatic gain control based upon the occurrences counted.

1 35. The method of claim 34, wherein:  
2 comparing the input signal level against a first reference threshold value and a  
3 second threshold value; and  
4 counting occurrences in which the input signal level is above the first reference  
5 threshold value and occurrences in which the input signal level is below the second  
6 reference threshold value.

1 36. The method of claim 34, wherein further comprising varying the speed by  
2 which the gain is adjusted by gear shifting based upon the distribution.